1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier
- Hafnium Powder and Fines

Other means of identification
- Product Name: Hafnium Powder and Fines
- Product Code: SAC023
- UN/ID No.: 3089
- Synonyms: Hafnium metal, dry. (Product #403)

Recommended use of the chemical and restrictions on use
- Recommended Use: Alloy product manufacture.
- Uses advised against:
  - Ground/bond container and receiving equipment
  - If dust clouds can occur, use explosion-proof electrical/ventilating/lighting/equipment

Details of the supplier of the safety data sheet
- Manufacturer Address: ATI, 1000 Six PPG Place, Pittsburgh, PA 15222 USA
- Emergency telephone number: Chemtrec: 1-800-424-9300

2. HAZARDS IDENTIFICATION

Classification
- This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

| Flammable solids | Category | 1 |

Label elements
- Emergency Overview

Danger
- Hazard statements: Flammable solids

Appearance Powder  Physical state Solid  Odor Odorless

Precautionary Statements - Prevention
- Wear protective gloves/protective clothing/eye protection
- Keep away from heat/sparks/open flames/hot surfaces. - No smoking
- Ground/bond container and receiving equipment
- If dust clouds can occur, use explosion-proof electrical/ventilating/lighting/equipment
Precautionary Statements - Response
In case of fire: Use salt (NaCl) or class D dry powder for extinction

Hazards not otherwise classified (HNOC)
Not applicable
Other Information

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms
Hafnium metal, dry. (Product #403).

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS No.</th>
<th>Weight-%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium</td>
<td>7440-58-6</td>
<td>97- &gt;99</td>
</tr>
<tr>
<td>Zirconium</td>
<td>7440-67-7</td>
<td>0-3</td>
</tr>
</tbody>
</table>

4. FIRST AID MEASURES

First aid measures
Eye contact
In the case of particles coming in contact with eyes during processing, treat as with any foreign object.

Skin Contact
None under normal use conditions.

Inhalation
If excessive amounts of smoke, fume, or particulate are inhaled during processing, remove to fresh air and consult a qualified health professional.

Ingestion
IF SWALLOWED. Call a POISON CENTER or doctor/physician if you feel unwell.

Most important symptoms and effects, both acute and delayed

Symptoms
None anticipated.

Indication of any immediate medical attention and special treatment needed

Note to physicians
Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media
Isolate large fires and allow to burn out. Smother small fires with salt (NaCl) or class D dry powder fire extinguisher.

Unsuitable extinguishing media
Do not spray water on burning metal as an explosion may occur. This explosive characteristic is caused by the hydrogen and steam generated by the reaction of water with the burning material.

Specific hazards arising from the chemical
Intense heat. Very fine, high surface area material resulting from processing this product may ignite spontaneously at room temperature. WARNING: Fine particles of this product may form combustible dust-air mixtures. Keep particles away from all ignition sources including heat, sparks, and flame. Prevent dust accumulations to minimize combustible dust hazard.

Hazardous combustion products
Not applicable.

Explosion data
Sensitivity to Mechanical Impact None.
Sensitivity to Static Discharge May be ignited by heat, sparks or flames.
Protective equipment and precautions for firefighters
Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions
Use personal protective equipment as required.

For emergency responders
Use personal protective equipment as required. Follow Emergency Response Guidebook, Guide No. 170.

Environmental precautions

Environmental precautions
Collect spillage to prevent release to the environment.

Methods and material for containment and cleaning up

Methods for containment
Prevent further leakage or spillage if safe to do so.

Methods for cleaning up
Sweep or shovel material into dry containers using non-sparking tools. Avoid creating uncontrolled dust.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling
Intense heat. Very fine, high surface area material resulting from grinding, buffing, polishing, or similar processes of this product may ignite spontaneously at room temperature. WARNING: Fine particles of this product may form combustible dust-air mixtures. Keep particles away from all ignition sources including heat, sparks, and flame. Prevent dust accumulations to minimize combustible dust hazard.

Conditions for safe storage, including any incompatibilities

Storage Conditions
Keep away from heat, sparks, flame and other sources of ignition (i.e., pilot lights, electric motors and static electricity). For long-term storage, keep sealed in argon-filled steel drums.

Incompatible materials
Dissolves in hydrofluoric acid. Ignites in the presence of fluorine. When heated above 200°C, reacts exothermically with the following. Chlorine, bromine, halocarbons, carbon tetrachloride, carbon tetrafluoride, and freon.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>ACGIH TLV</th>
<th>OSHA PEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium 7440-58-6</td>
<td>TWA: 0.5 mg/m³ TWA: 0.5 mg/m³ Hf</td>
<td>TWA: 0.5 mg/m³</td>
</tr>
<tr>
<td>Zirconium 7440-67-7</td>
<td>STEL: 10 mg/m³ STEL: 10 mg/m³ Zr TWA: 5 mg/m³ TWA: 5 mg/m³ Zr</td>
<td>TWA: 5 mg/m³ Zr (vacated) STEL: 10 mg/m³ (vacated) STEL: 10 mg/m³ Zr</td>
</tr>
</tbody>
</table>

Appropriate engineering controls

Engineering Controls
Avoid generation of uncontrolled particles.

Individual protection measures, such as personal protective equipment

Eye/face protection
When airborne particles may be present, appropriate eye protection is recommended. For
example, tight-fitting goggles, foam-lined safety glasses or other protective equipment that
shield the eyes from particles.

**Skin and body protection**
Fire/flame resistant/retardant clothing may be appropriate during hot work with the product.

**Respiratory protection**
When particulates/fumes/gases are generated and if exposure limits are exceeded or
irritation is experienced, proper approved respiratory protection should be worn.
Positive-pressure supplied air respirators may be required for high airborne contaminant
concentrations. Respiratory protection must be provided in accordance with current local
regulations.

**General Hygiene Considerations**
Handle in accordance with good industrial hygiene and safety practice.

---

### 9. PHYSICAL AND CHEMICAL PROPERTIES

**Information on basic physical and chemical properties**

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Remarks • Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical state</td>
<td>Solid</td>
<td></td>
</tr>
<tr>
<td>Appearance</td>
<td>Powder</td>
<td>Odor</td>
</tr>
<tr>
<td>Color</td>
<td>metallic gray or silver</td>
<td>Odor threshold</td>
</tr>
<tr>
<td>pH</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Melting point/freezing point</td>
<td>2227 °C / 4050 °F</td>
<td></td>
</tr>
<tr>
<td>Boiling point / boiling range</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Flash point</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>-</td>
<td>Flammable</td>
</tr>
<tr>
<td>Flammability Limit in Air</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper flammability limit:</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Lower flammability limit:</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Vapor pressure</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Vapor density</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>13.3</td>
<td></td>
</tr>
<tr>
<td>Water solubility</td>
<td>Insoluble</td>
<td></td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Partition coefficient</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Autoignition temperature</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Decomposition temperature</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Kinematic viscosity</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Dynamic viscosity</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Explosive properties</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td>Oxidizing properties</td>
<td>Not applicable</td>
<td></td>
</tr>
</tbody>
</table>

**Other Information**

- Softening point
- Molecular weight
- VOC Content (%)
- Odor
- Odor threshold
- pH
- Water solubility
- Insoluble
- Partition coefficient
- Not applicable
- Autoignition temperature
- Not applicable
- Decomposition temperature
- Not applicable
- Kinematic viscosity
- Not applicable
- Dynamic viscosity
- Not applicable
- Explosive properties
- Not applicable
- Oxidizing properties
- Not applicable
- Softening point
- -
- Molecular weight
- -
- VOC Content (%)
- Not applicable
- Odor
- -
- Odor threshold
- Not applicable
- pH
- Melting point/freezing point
- 2227 °C / 4050 °F
- Boiling point / boiling range
- -
- Flash point
- -
- Evaporation rate
- -
- Flammability (solid, gas)
- -
- Flammability Limit in Air
- -
- Upper flammability limit:
- -
- Lower flammability limit:
- -
- Vapor pressure
- -
- Vapor density
- -
- Specific Gravity
- 13.3
- Water solubility
- Insoluble
- Partition coefficient
- -
- Autoignition temperature
- -
- Decomposition temperature
- -
- Kinematic viscosity
- -
- Dynamic viscosity
- -
- Explosive properties
- Not applicable
- Oxidizing properties
- Not applicable
- Softening point
- -
- Molecular weight
- -
- VOC Content (%)
- Not applicable
- Odor
- -
- Odor threshold
- Not applicable
- pH
- Melting point/freezing point
- 2227 °C / 4050 °F
- Boiling point / boiling range
- -
- Flash point
- -
- Evaporation rate
- -
- Flammability (solid, gas)
- -
- Flammability Limit in Air
- -
- Upper flammability limit:
- -
- Lower flammability limit:
- -
- Vapor pressure
- -
- Vapor density
- -
- Specific Gravity
- 13.3
- Water solubility
- Insoluble
- Partition coefficient
- -
- Autoignition temperature
- -
- Decomposition temperature
- -
- Kinematic viscosity
- -
- Dynamic viscosity
- -
- Explosive properties
- Not applicable
- Oxidizing properties
- Not applicable

**10. STABILITY AND REACTIVITY**

**Reactivity**
Not applicable

**Chemical stability**
Stable under normal conditions.

**Possibility of Hazardous Reactions**
None under normal processing.

Hazardous polymerization
Hazardous polymerization does not occur.

Conditions to avoid
Dust formation and dust accumulation.

Incompatible materials
Dissolves in hydrofluoric acid. Ignites in the presence of fluorine. When heated above 200°C, reacts exothermically with the following. Chlorine, bromine, halocarbons, carbon tetrachloride, carbon tetrafluoride, and freon.

Hazardous Decomposition Products
Not applicable.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information

Inhalation
Product not classified.

Eye contact
Product not classified.

Skin Contact
Product not classified.

Ingestion
Product not classified.

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Oral LD50</th>
<th>Dermal LD50</th>
<th>Inhalation LC50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium 7440-58-6</td>
<td>&gt; 5000 mg/kg bw</td>
<td>-</td>
<td>&gt;4.3 mg/L</td>
</tr>
<tr>
<td>Zirconium 7440-67-7</td>
<td>5000 mg/kg bw</td>
<td>-</td>
<td>&gt;4.3 mg/L</td>
</tr>
</tbody>
</table>

Information on toxicological effects

Symptoms
None known.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Acute toxicity
Product not classified.

Skin corrosion/irritation
Product not classified.

Serious eye damage/eye irritation
Product not classified.

Sensitization
Product not classified.

Germ cell mutagenicity
Product not classified.

Carcinogenicity
Product not classified.

Reproductive toxicity
Product not classified.

STOT - single exposure
Product not classified.

STOT - repeated exposure
Product not classified.

Aspiration hazard
Product not classified.

12. ECOLOGICAL INFORMATION

Ecotoxicity

This product as shipped is not classified for aquatic toxicity.

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Algae/aquatic plants</th>
<th>Fish</th>
<th>Toxicity to microorganisms</th>
<th>Crustacea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium</td>
<td>The 72 h EC50 of hafnium</td>
<td>The 96 h LC50 of Hafnium</td>
<td>-</td>
<td>The 48 h EC50 of Hafnium</td>
</tr>
</tbody>
</table>
### Persistence and degradability

- Biodegradability

### Bioaccumulation

- Bioaccumulation

### Other adverse effects

#### 13. DISPOSAL CONSIDERATIONS

<table>
<thead>
<tr>
<th>Waste treatment methods</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Disposal of wastes</strong></td>
<td>Disposal should be in accordance with applicable regional, national and local laws and regulations.</td>
</tr>
<tr>
<td><strong>Contaminated packaging</strong></td>
<td>Disposal should be in accordance with applicable regional, national and local laws and regulations.</td>
</tr>
</tbody>
</table>

This product contains one or more substances that are listed with the State of California as a hazardous waste.

#### 14. TRANSPORT INFORMATION

<table>
<thead>
<tr>
<th>DOT</th>
<th>Regulated</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UN/ID No.</strong></td>
<td>3089</td>
</tr>
<tr>
<td><strong>Proper shipping name</strong></td>
<td>Metal powder, flammable, n.o.s. (Hafnium)</td>
</tr>
<tr>
<td><strong>Hazard Class</strong></td>
<td>4.1</td>
</tr>
<tr>
<td><strong>Packing Group</strong></td>
<td>II</td>
</tr>
<tr>
<td><strong>Special Provisions</strong></td>
<td>IB8, IP2, IP4, T3, TP33</td>
</tr>
<tr>
<td><strong>Emergency Response Guide Number</strong></td>
<td>170</td>
</tr>
</tbody>
</table>

#### 15. REGULATORY INFORMATION

### International Inventories

<table>
<thead>
<tr>
<th>Inventory</th>
<th>Complies</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSCA</td>
<td></td>
</tr>
<tr>
<td>DSL/NDSL</td>
<td></td>
</tr>
<tr>
<td>EINECS/ELINCS</td>
<td></td>
</tr>
<tr>
<td>ENCS</td>
<td></td>
</tr>
<tr>
<td>IECSC</td>
<td></td>
</tr>
<tr>
<td>KECL</td>
<td></td>
</tr>
<tr>
<td>PICCS</td>
<td></td>
</tr>
<tr>
<td>AICS</td>
<td>Not Listed</td>
</tr>
</tbody>
</table>

**Legend:**

- TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
- DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
- EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
- ENCS - Japan Existing and New Chemical Substances
- IECSC - China Inventory of Existing Chemical Substances
- KECL - Korean Existing and Evaluated Chemical Substances
US Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

- Acute health hazard: No
- Chronic Health Hazard: No
- Fire hazard: Yes
- Sudden release of pressure hazard: No
- Reactive Hazard: No

CWA (Clean Water Act)
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

US State Regulations

California Proposition 65
This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>New Jersey</th>
<th>Massachusetts</th>
<th>Pennsylvania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium 7440-58-6</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Zirconium 7440-67-7</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

U.S. EPA Label Information

EPA Pesticide Registration Number: Not applicable

16. OTHER INFORMATION

<table>
<thead>
<tr>
<th>NFPA</th>
<th>Health hazards</th>
<th>Flammability</th>
<th>Instability</th>
<th>Physical and Chemical Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HMIS</th>
<th>Health hazards</th>
<th>Flammability</th>
<th>Physical hazards</th>
<th>Personal protection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1*</td>
<td>2</td>
<td>0</td>
<td>X</td>
</tr>
</tbody>
</table>

Chronic Hazard Star Legend

- * = Chronic Health Hazard

Issue Date: 28-May-2015
Revision Date: 10-Apr-2019
Revision Note: Updated Section(s): 2, 5, 6, 7, 9, 11, 14, 15

Note:
The information provided in this safety data sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
Additional information available from: Safety data sheets and labels available at ATImetals.com

End of Safety Data Sheet